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REVIEW

Practical view of the topical treatment of peripheral venous catheter-related phlebitis: A scoping review

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Abstract

Objective: To identify and analyse topical treatments for peripheral venous catheter (PVC)-related phlebitis.

Design: The methodological framework used to make this scoping review was developed by Arksey and O'Malley (2005; (International Journal of Social Research Methodology, 8, 2005 and 19)).

Data sources: A literature search was performed in various databases such as PubMed, Scopus, CINAHL, Cochrane, Cuiden, Web of Science, WorldWideScience and Joanna Briggs. Additionally, articles from informal sources were incorporated.

Review methods: A search and selection were made of experimental, quasi-experimental and pre-experimental studies published between January 2015 and September 2020 that consider the use of topical products for the treatment of hospital in-patients with PVC-related phlebitis. Appraisal of the methodological quality of the study was performed independently by pairs of reviewers on the basis of the Cochrane Collaboration tool. The review was based on the guidelines in the PRISMA-ScR statement.

Results: Twenty-two articles were selected (8 randomised controlled trials (RCTs), 12 quasi-RCTs and 2 pre-experimental studies) which considered treatments applied to a total of 2042 adult patients. The topical treatments described were classified into physical measures and phytotherapeutic and pharmacological treatments. The physical measures are easy to apply, but their effectiveness is limited. The main limitation of the phytotherapeutic treatments is their marketing and use in eastern culture. The best performing pharmacological treatment is the application of magnesium sulphate either with or without glycerine. These products can be presented in different pharmaceutical formulas: ointment, solution and oil.

Conclusions and relevance to clinical practice: The evidence currently available on this issue is limited and often of dubious methodological rigour. Further studies are required on the treatment and follow-up of intravenous therapy-related phlebitis in different national and international contexts.

KEYWORDS
intravenous infusion, peripheral venous catheter, phlebitis, therapeutic, topical treatment

1 | INTRODUCTION

Phlebitis or thrombophlebitis is a frequent complication of intravenous catheters inserted into peripheral veins (Di Nisio et al., 2015). The resulting inflammation may be due to mechanical, chemical or bacterial factors (Higginson & Parry, 2011; Urbanetto et al., 2017). Symptoms include erythema, warmth, swelling and the formation of fibrous cords that are palpable along the venous passageway (Dos Reis et al., 2009; Webster et al., 2015). A meta-analysis found no statistically significant correlations between the occurrence of phlebitis and catheter gauge, insertion site or the duration of the catheterisation (Chang & Peng, 2018). Phlebitis may present while the peripheral venous catheter (PVC) is in situ and up to 96 h after its removal. However, it is normally detected during the first 24–72 h (Urbanetto et al., 2017).

The wide disparity (from 0% to 80%) in the reported incidence rate of phlebitis (Di Nisio et al., 2015; Ray-Barruel et al., 2014) is attributable to the lack of consensus on its assessment (Mihala et al., 2018; Webster et al., 2015). As well as its clinical significance, various studies (Nassaji-Zavareh & Ghorbani, 2007; Urbanetto et al., 2017) have shown that phlebitis entails additional economic costs for the healthcare system and longer hospital stays, and may lead to more serious medical complications.

With respect to the treatment to be applied, there is general agreement that the first step should be to immediately interrupt the infusion and remove the PVC (Webster et al., 2015). Systemic and topical treatments are available, with the latter the most commonly used to control symptoms and alleviate patient discomfort (Di Nisio et al., 2015; Lian et al., 2017). However, there is a lack of consensus on topical interventions, with only two systematic reviews conducted on this topic (Goulart et al., 2020; Martín Gil et al., 2017). The study by Martín Gil et al. (2017) reported on the pharmacological (heparinoids, diclofenac, nitroglycerine) and phytotherapeutic products (chamomile, notoginseny, aloe vera) used in the treatment of phlebitis. Other products analysed in the study by Goulart et al. (2020) included sesame and rosemary, although it should be noted that the study considered topical interventions for both the treatment and prevention of PVC-related phlebitis. It should also be noted that some of the studies included in these reviews are relatively old (1998, 1999 or 2000) and that the focus of the analysis was centred on the products. The products that are available and effective need to be included in the treatment protocols for PVC-related phlebitis that are urgently required by nursing professionals to help in the clinical decision-making process.

This present review is therefore complementary to the previous reviews that have been performed and its objectives are: (1) to further the understanding and knowledge about the treatment of phlebitis for the reasons set out (high incidence, economic cost, patient discomfort and possible complications); (2) to update the analysis of PVC-related phlebitis in accordance with recently published evidence; and (3) to undertake an in-depth analysis of the proposed therapies, especially in relation to the products and the way they are administered.

What does this paper contribute to the wider global clinical community?

- The medical approach to PVC-related phlebitis remains an unresolved clinical issue which has a direct impact on patient healthcare quality and safety as well as an economical impact on the health system.
- The present review shows that el magnesium sulphate either with or without glycerine is postulated as the most effective treatment. However, this result is not definitive. The results of this scoping currently available in the literature are predominantly of Asian origin. Some of these studies use products that are not marketed in a Western sanitary context. That is why research in other regions of the world is urgently required in order to form a consensus and facilitate contextual adaptation of the therapies to be applied.
- Such new research should focus not only on the products themselves but also consider administrative aspects and interventions to enable a better comparison of studies and avoid the present high degree of heterogeneity. The results would help all nurses in their clinical practice worldwide to standardise care plans and really base the cure for PVC-related phlebitis on evidence.

2 | AIMS

This scoping review aims to identify and analyse topical treatments for PVC-related phlebitis.

3 | METHODS

A scoping review entails a systematic 'mapping' of the literature and scientific evidence with a view to summarising the research results on a specific topic (Arksey & O'Malley, 2005). The present scoping review follows the methodological approach of Arksey and O'Malley (2005). The process is divided into 5 stages. Moreover, in order to develop a greater understanding of relevant terminology, core

concepts and key items to report for this scoping review, Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) was used (Appendix S1).

3.1 | Stage 1: identifying the research question

The research questions identified in stage 1 and used as the basis for the search strategies are as follows:

1. What topical treatments are used to tackle the problem of PVC-related phlebitis in adult hospital in-patients?
2. How are these treatments applied?
3. According to the results obtained, are the products and the means of administration of these treatments effective?

3.2 | Stage 2: identifying relevant studies

Identification of the studies was undertaken through a systematic electronic database search of PubMed, Scopus, Cochrane Library, CINAHL, Cuiden, Web of Science, WorldWideScience and Joanna Briggs. Articles identified through other sources such as ScienceDirect, Google Scholar, ProQuest Dissertations and Theses Global, were also incorporated. In order to reduce publication bias, articles from informal sources were additionally included. Appropriate keywords were selected using MeSH or free descriptors: 'Phlebiti*', 'Periphlebiti*', 'Thrombophlebiti*', 'Catheterization, Peripheral', 'Infusions, Intravenous', 'Intravenous Infusion*', 'Intravenous drip', 'Administration, Topical', 'Administration, Cutaneous', 'Therap*', 'Treatment*'.

Articles included in this scoping review met the following specified inclusion criteria: (1) randomised controlled trial (RCT), quasi-experimental (quasi-RCT) or pre-experimental designs; (2) adult hospital in-patients who had undergone PVC insertion, been diagnosed with any grade of upper limb phlebitis during their hospital stay and been treated with a topical therapy; (3) published in English or Spanish; and (4) published between January 2015 and September 2020. Papers which included patients with other venous catheters, or which focused exclusively on paediatric populations, phlebitis prevention treatments and patients with bacterial and bloodstream phlebitis were excluded.

3.3 | Stage 3: study selection

The first step in the study selection process was to import all the database search results into Mendeley, version 1.19.3 (https://www.mendeley.com) and screen for duplicates. The study selection process was exported to a database manager generated by the authors of the present study in Excel (version 16.16.6). Two review authors (JG, OM) independently screened the titles and abstracts of the identified references and eliminated any irrelevant studies.

In step 2, the full text of the remaining studies was obtained and screened independently by two review authors (JG, OM) with a third (JR) resolving any disputes. Studies ranked as irrelevant by both reviewers were excluded. The research team maintained continuous contact, following an iterative process for the search strategy, and the selection and inclusion of the articles.

3.4 | Stage 4: charting the data

Following initial screening, two reviewers (OM, JR) extracted four specific components using a standardised form: (1) General data (author(s), year of publication, country); (2) Methodological elements (design, sample); (3) Data of the intervention (setting, product, phlebitis evaluation, form of administration); and (4) data evaluating treatment efficacy (results/outcomes measures).

Additionally, even though it is not mandatory to assess the methodological quality in a scoping review (Arksey and O'Malley, 2005), this was performed using the Cochrane Collaboration tool described in the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al., 2019). Two reviewers (JR and JG) independently evaluated the quality of the included studies and the results were compared for precision and consistency, while OM resolved any discrepancies.

3.5 | Stage 5: collating, summarising and reporting the results

The interventions were classified according to the nature of the treatments (pharmacological, phytotherapeutic and/or physical measures), the pharmacological presentation, the mode of application and their effect in relation to the regression of the degree of phlebitis or of the signs or symptoms associated with it.

4 | RESULTS

4.1 | Identification and selection of relevant papers

A total of 147 references were identified through the various database search strategies. A manual and grey literature search identified a further 121 studies, making a total of 268 records.

After eliminating duplicates (n = 45), an initial screening of the remaining potentially eligible articles (n = 223) was performed on the basis of their titles and abstracts. The full text of the remaining articles (n = 28) was subsequently analysed, and those that did not meet the inclusion criteria were excluded. The final total of articles included in this review was 22. The process that was followed is shown in the PRISMA flow diagram below (Figure 1).

The degree of agreement between study evaluations was measured using the Kappa Index, giving a result of 0.812 (indicating very good agreement).

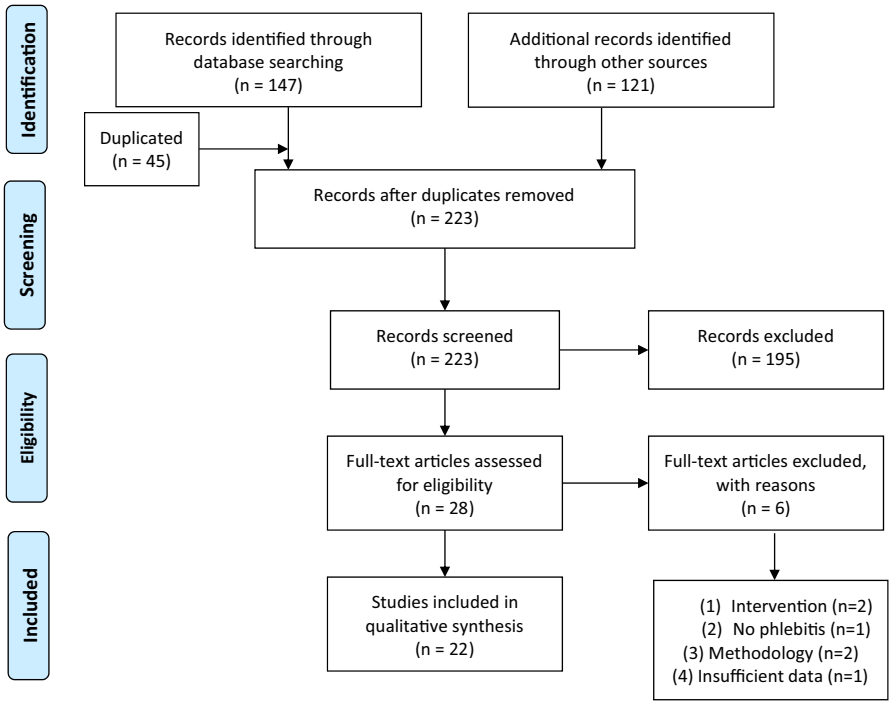

FIGURE 1 PRISMA 2009 flow diagram

4.2 | Characteristics of included studies

The relevant characteristics of the studies included are summarised in Table 1. By design, of the total of 22 selected studies 8 were RCTs, 12 quasi-RCTs and 2 pre-experimental. These were carried out in India (*n* = 16), China (*n* = 1), Indonesia (*n* = 1), Nepal (*n* = 1) and Iran (*n* = 3).

The total number of patients included in the studies was 2042, ranging in age from 17 to 70 except in the studies by Ravindra and Patel Krupa (2015) and Basu et al. (2017) which also included paediatric patients. 55.1% of the patients were male and 44.9% female.

Of the total number of patients, 86% were in medical or surgical wards (oncology, orthopaedics, gastro, pulmonology, cardiology and internal medicine), and the remainder (14%) in intensive care units (ICUs).

The most frequently used tool to assess the incidence and severity of phlebitis was the Visual Infusion Phlebitis (VIP) score, also known as the Jackson scale (*n* = 12). The modified VIP score was also applied (*n* = 5). The other 5 scales that were used were the Numeric Rating Scale (*n* = 1), the Infiltration Scale (*n* = 1), the Thrombophlebitis Scale (*n* = 1), the Standard Visual Rating Scale (*n* = 1) and the Visual Analogue Scale (VAS) The most assessed sign was pain through the VAS (*n* = 7). Other signs and symptoms of phlebitis that were assessed included surrounding red swelling, hyperaemia, warmness, redness, tenderness and oedema.

4.3 | Validity and methodological quality

Figure 2 shows the detailed assessment of the risk of bias for the papers included in this review. 50% present a low risk of bias in the generation of random sequences, though it should be noted that 12 of the included studies were quasi-RCT and 2 pre-experimental. Allocation concealment (selection bias) only took place in three of the studies (Bigdeli Shamloo et al., 2019; Ghorbani et al., 2016; Selva Grace et al., 2020). A similar situation of uncertainty is found in the blinding of participants and personnel (performance bias), which is only described in 4 of the studies (Basu et al., 2017; Ghorbani et al., 2016; Selva Grace et al., 2020; Sharma, 2016), and in the blinding of results assessment (detection bias), which is reported in just 3 studies (Basu et al., 2017; Bigdeli Shamloo et al., 2019; Selva Grace et al., 2020). Reporting bias is high (63.6%), mainly due to insufficient data or the absence of a pre-specified protocol. In contrast, 63.6% of the cases are presented with full results data or the missing data do not have a sufficient effect for the study.

4.4 | Findings of the review

The main findings in relation to the products, presentation, dosage, mode of application and their effectiveness are presented in Table 2.

The findings were classified into 3 groups: (1) Physical measures; (2) Phytotherapeutic treatments; and (3) Pharmacological treatments.

4.4.1 | Physical measures

The physical measures reported in the studies were the application of cold, warmth and heat. Three of the eight studies which included physical measures reported better results in terms of regression of the phlebitis or hyperaemia: heat (Shilpa et al., 2015),

TABLE 1 Characteristics of the selected studies

Reference, country	Design	Sample	Setting	Phlebitis evaluation
Selva Grace et al. (2020), India	RCT	*n* = 110	In-patient, surgical and orthopaedic wards	VIP score VAS score (pain)
Bigdeli Shamloo et al. (2019), Iran	RCT	*n* = 60	In-patient, oncology ward	VIP score VAS score (pain)
Amuda et al. (2019), Nepal	Quasi-RCT	*n* = 50	In-patient, surgical and medical wards	VIP score
Wan (2018), China	RCT	*n* = 600	In-patient	Symptoms: surrounding, red swelling and heat pain
Varghese and Moly (2018), India	Quasi-RCT	*n* = 60	In-patient, orthopaedics, surgical, medical, gastro, pulmonology and cardiology wards	VIP score
Hidayah et al. (2017), Indonesia	Quasi-RCT	*n* = 40	In-patient, not in chemotherapy or postoperative wards	Hyperaemia
Lila (2017), India	Pre-experimental	*n* = 60	In-patient, oncology ward	Modified VIP score
Damanik (2017), India	RCT	*n* = 40	In-patient, oncology ward	VAS score Numeric Rating Scale
Basu et al. (2017), India	RCT single-blind	*n* = 120	In-patient, cardiac centre	Jackson score
Jourabloo et al. (2017), Iran	RCT	*n* = 96	In-patient, surgery unit	Jackson score
Packialakshmi and Vidhya (2017), India	Quasi-RCT	*n* = 30	In-patient	VIP score Infiltration Scale VAS score (pain)
Vidhya (2017), India	Quasi-RCT	n = 60	In-patient	Modified VIP score
Yadav et al. (2016), India	Quasi-RCT	*n* = 90	In-patient, medical, surgical and other wards	VIP score
Sharma (2016), India	Quasi-RCT	*n* = 150	In-patient, surgical and medical wards	Superficial Thrombophlebitis scale Modified VAS (pain)
Ghorbani et al. (2016), Iran	RCT single-blind	*n* = 66	In-patient, internal medicine ward	Standard visual rating scale Warmness, redness, pain, tenderness or oedema
Thomas et al. (2016), India	Quasi-RCT	*n* = 90	In-patient, medical, surgical and orthopaedic wards	VIP score VAS score (pain)
Rukhsana et al. (2016), India	Quasi-RCT	*n* = 30	In-patient	VIP score
Jayabharathi (2015), India	RCT	*n* = 60	In-patient, various wards and ICU	Modified VIP score
Ravindra and Patel Krupa (2015), India	Quasi-RCT	*n* = 60	In-patient	Jackson score
Soloman et al. (2015), India	Quasi-RCT	*n* = 60	In-patient, ICU	Modified VIP VAS score (pain)
Yambem et al. (2015), India	Pre-experimental	*n* = 30	In-patient, ICU	Modified VIP score
Shilpa et al. (2015), India	Quasi-RCT	*n* = 80	In-patient	VIP score
Ghorbani et al. (2016), Iran	RCT single-blind	*n* = 66	In-patient, internalmedicine ward	Standard visual rating scale Warmness, redness, pain, tenderness or oedema

(Continues)

TABLE 1 (Continued)

Reference, country	Design	Sample	Setting	Phlebitis evaluation
Thomas et al. (2016), India	Quasi-RCT	*n* = 90	In-patient, medical, surgical and orthopaedic wards	VIP score VAS score (pain)
Rukhsana et al. (2016), India	Quasi-RCT	*n* = 30	In-patient	VIP score
Jayabharathi (2015), India	RCT	*n* = 60	In-patient, various wards and ICU	Modified VIP score
Ravindra and Patel Krupa (2015), India	Quasi-RCT	*n* = 60	In-patient	Jackson score
Soloman et al. (2015), India	Quasi-RCT	*n* = 60	In-patient, ICU	Modified VIP VAS score (pain)

Abbreviations: ICU, intensive care unit; Quasi-RCT, quasi-experimental study; RCT, randomised controlled trial; VAS, Visual Analogue Scale; VIP, Visual Infusion Phlebitis.

cold vs. glycerine and aloe vera (Yadav et al., 2016) and warmth vs. untreated (Hidayah et al., 2017). In the study by Rukhsana et al. (2016), cold and magnesium sulphate-glycerine were found to be equally effective.

As for the mode of administration, cold was applied through ice packs or compresses at <15°C (Jayabharathi, 2015; Rukhsana et al., 2016; Sharma, 2016; Varghese & Moly, 2018), warmth through warm water compresses at 45°C (Hidayah et al., 2017; Jourabloo et al., 2017), and heat also through compresses but without specifying the temperature (Shilpa et al., 2015). The treatments were applied for 5–20 min every 8 or 12 h during 2–3 days.

4.4.2 | Phytotherapeutic treatments

The potential of phytotherapeutic treatments was explored in 11 of the studies included in this review in relation to the application of phellodendron, quercetin, ichthammol glycerine, calendula, chamomile, sesame and aloe vera. A total of 8 studies reported an improvement in the phlebitis: calendula vs. application of warmth (Jourabloo et al., 2017), quercetin vs. eucerin (Ghorbani et al., 2016), phellodendron vs. magnesium sulphate (Wan, 2018) and ichthammol glycerine vs. heparinoids or magnesium sulphate-glycerine (Basu et al., 2017; Thomas et al., 2016). In the study by Soloman et al. (2015), ichthammol glycerine and heparinoids were found to be equally effective. Sesame was found to be effective for the control of pain only in comparison with massage (Bigdeli Shamloo et al., 2019) or alcohol compresses (Damanik, 2017). Other authors (Lila, 2017) highlighted the clinical value of chamomile. Finally, aloe vera was the only phytotherapeutic product to be found less effective than the treatments they were compared with (Vidhya, 2017; Yadav et al., 2016).

The phytotherapeutic products were in the form of solution (phellodendron and ichthammol glycerine), oil (sesame and chamomile) and ointment (calendula, aloe vera and quercetin). The application times varied considerably, from every 2 h to every 12 h and for 2–7 days.

The solutions were applied with a compress and bandage. In the case of the phellodendron, the treatment was applied every 2 h for 2 days and the limb was raised, wrapped in plastic and immobilised (Wan, 2018). The ichthammol glycerine was administered twice a day for 3 days (Thomas et al., 2016).

The oil-based treatments were applied by massage or using a compress. Chamomile (2.5 ml) was applied in a 10-min massage 3 times a day for 3 days (Lila, 2017). The sesame treatment was applied (3 ml) in a 5-min massage twice a day for 7 days (Bigdeli Shamloo et al., 2019), or with a compress twice a day (Damanik, 2017).

Application of the ointment-based treatment was by massage and dressing. The calendula was applied by massage 3 times a day for 3 days (Jourabloo et al., 2017), the aloe vera with a gauze dressing twice a day for 2 days (Vidhya, 2017) and the quercetin with a sterile dressing twice a day for 3 days (Ghorbani et al., 2016).

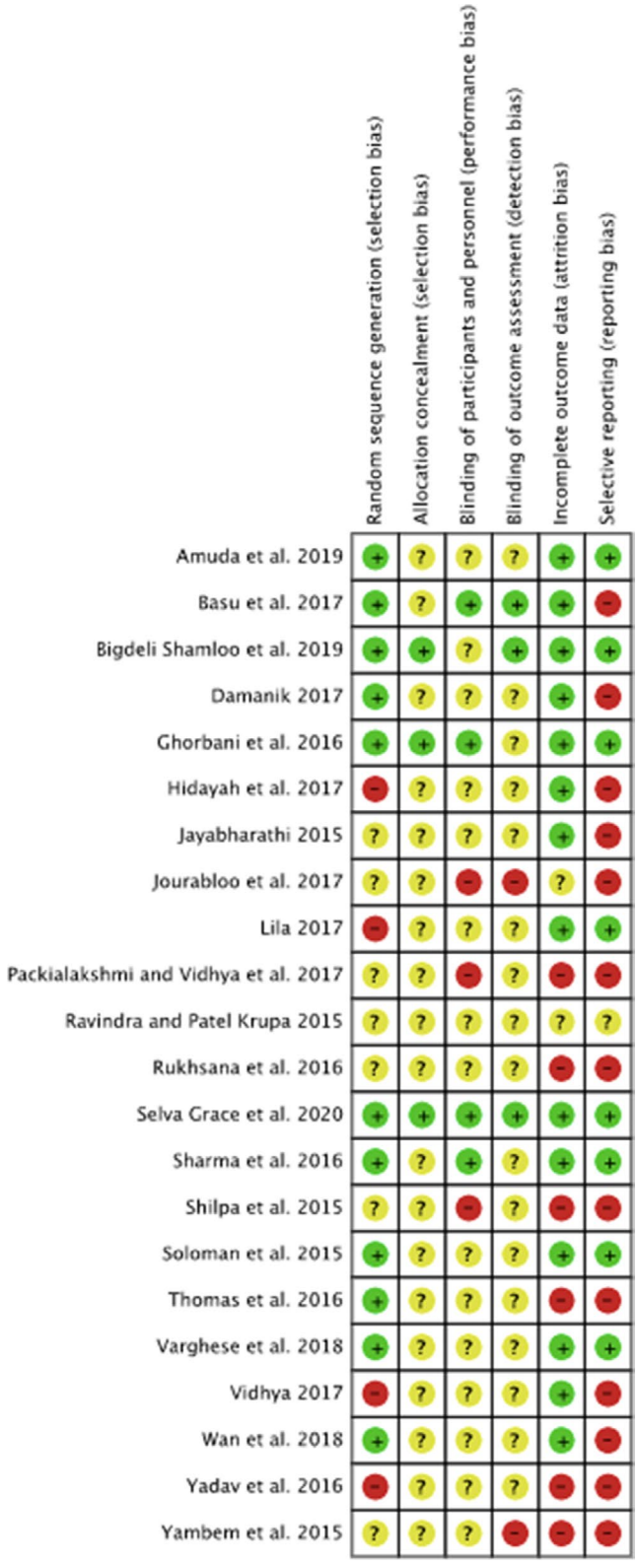

FIGURE 2 Risk of bias summary. *+: low risk, (–) high risk, (?) unclear risk

4.4.3 | Pharmacological treatments

Pharmacological products were used in 13 studies. These were divided into three groups: anti-inflammatories (magnesium sulphate-glycerine, magnesium sulphate), antithrombotics (heparinoid) and moisturisers (glycerine).

Of the 9 studies which considered anti-inflammatories, 7 reported an improvement in symptoms: magnesium sulphate-glycerine (Packialakshmi & Vidhya, 2017; Ravindra & Patel Krupa, 2015), vs. the application of cold (Varghese & Moly, 2018) and vs. heparinoids (Amuda et al., 2019; Jayabharathi, 2015; Selva Grace et al., 2020; Yambem et al., 2015). Magnesium sulphate without glycerine obtained a better response than heparinoids and the application of cold (Sharma, 2016) and aloe vera (Vidhya, 2017). As for the antithrombotics, heparinoids were tested in 6 studies, but none obtained higher efficacy than the anti-inflammatories or phytotherapeutic products. Glycerine was only tested in one study, and its efficacy was found to be the same as that of aloe vera and lower than the application of cold (Yadav et al., 2016).

Concerning the mode of administration, some studies (Basu et al., 2017; Selva Grace et al., 2020; Soloman et al., 2015; Yadav et al., 2016; Yambem et al., 2015) provided no information In this respect, magnesium sulphate-glycerine was administered in solution form (Amuda et al., 2019; Packialakshmi & Vidhya, 2017; Varghese & Moly, 2018) through compress and bandage 2 or 3 times a day for 2 or 3 days, in ointment form 3 times a day for 3 days (Jayabharathi, 2015; Rukhsana et al., 2016), and with a bandage and raised limb twice a day for 2 days (Ravindra & Patel Krupa, 2015). Magnesium sulphate was applied every 2 h for 2 days in solution form with a compress, and the limb was raised, wrapped in plastic and immobilised (Wan, 2018), or it was applied in ointment form with a gauze dressing twice or 3 times a day for 2 or 3 days (Sharma, 2016; Vidhya, 2017).

The heparinoids were only administered as ointments (Amuda et al., 2019; Sharma, 2016; Yambem et al., 2015) by massage each 8–12 h for 2–3 days, and a bandage (Thomas et al., 2016).

5 | DISCUSSION

A total of 22 articles were analysed for this scoping review. Various topical treatments were identified for PVC-related phlebitis. The results obtained are discussed below in terms of: (1) Assessment of the phlebitis, (2) Products used and their efficacy; and (3) Pharmaceutical formulas and administration interventions.

5.1 | Assessment of the phlebitis

The effectiveness of the treatments was determined on the basis of the signs and symptoms of the phlebitis and their evolution. It was found that no gold standard exists for the assessment of phlebitis. A total of 6 different scores/scales were found in the studies reviewed (VIP score, modified VIP score, Numeric Rating Scale, Infiltration Scale, Thrombophlebitis Scale and Standard Visual Rating Scale) and 7 phlebitis-related signs and symptoms (pain, surrounding red swelling, hyperaemia, warmness, redness, tenderness, oedema). This variety is at least partly due to the absence of universally accepted scales subjected to rigorous psychometric tests and validated for clinical

TABLE 2 Products, administration forms and results

Reference, country	Product	Presentation	Dosage	Mode of administration	Frequency of application	Results
Selva Grace et al. (2020), India	GI[1]: Magnesium sulphate-glycerine GI[2]: Heparinoid	Ointment/paste Ointment	Not reported Not reported	Not reported Not reported	12 h/2 days	VIP Score/pain: GI[1] vs. GI[2] ($p < .0001$). Reduction rates in phlebitis: GI[1] = 3.07, 1.51 and 0.55 GI[2] = 2.95, 2.67 and 1.78 Both effective at 48 h observation
Bigdeli Shamloo et al. (2019), Iran	GI: Sesame GC: Untreated (only massage)	Oil	3 ml	Before: washed with baby soap and saline solution (0.9%) Massage (5 min) with the rotatory technique in a 10 cm radius of the phlebitis After: sterile gauze	12 h/7 days	VAS score (pain): GI vs. GC ($p \leq .001$). Decreased pain severity during the 7 days Third day: (−2.30 ± 0.16 vs. −1.60 ± 0.19, $p = .009$) Fifth day: (−4.70 ± 0.16 vs. −2.80 ± 0.25, $p < 0.001$) Seventh day: (−6.80 ± 0.24 vs. −3.76 ± 0.31, $p < .001$)
Amuda et al. (2019), Nepal	GI[1]: Magnesium sulphate-glycerine GI[2]: Heparinoid	Solution Ointment	20 g/100 ml glycerine Not reported	Moist compress + bandage Gentle massage	8 h/2 days	VIP Score: GI[1] = GI[2] ($p < .05$). Magnesium sulphate-glycerine more effective. Pre- and post-test: GI[1] = (3.36 ± 0.757)/(0.120 ± 0.332) GI[2] = (3.00 ± 0.577)/(0.28 ± 0.577)
Wan (2018), China	GI: Phellodendron GC: Magnesium sulphate	Solution Solution	10 g/100 ml distilled water 50 g/100 ml distilled water	Washing of the area + moist compress 10 cm radius of the phlebitis + wrap limb in plastic + raise and immobilise limb	2 h/2 days	Symptoms (local vein, surrounding red swelling and heat pain): GI vs. GC ($p < .05$). GI = pain (42.3 ± 5.5), red swelling (72.6 ± 5.8) GC = pain (88.6 ± 6.7), red swelling (95.8 ± 7.4)
Varghese and Moly (2018), India	GI[1]: Magnesium sulphate-glycerine GI[2]: Cold	Solution Compress	30 mg/50 ml glycerine <15°C	Moist compress for 10 min Moist compress for 20 min	8 h/3 days	VIP Score: GI[1] vs. GI[2] ($p < .05$). Mean post-intervention GI[1] = 0.059 and GI[2] = 0.274.
Hidayah et al. (2017), Indonesia	GI: Warm water GC: Untreated	Compress	Not reported	Not reported	2 days	Hyperaemia: GI vs. GC ($p < .05$). Mean diameter: GI = before 49.3 mm / after 40.2 mm GC = before 48.1 mm/after 46.4 mm
Lila (2017), India	Chamomile	Oil	2.5 ml	Massage for 10 min	8 h/3 days	Modified VIP Score: $p \leq .05$. Pre-test 7.76 and post-test 2.19 (SD = 5.57, $t = 11.27$)

(Continues)

TABLE 2 (Continued)

Reference, country	Product	Presentation	Dosage	Mode of administration	Frequency of application	Results
Damanik (2017), India	GI: Sesame GC: Alcohol compress	Oil	2 ml	Moist compress for 30 min	2 times of 30 min. (with 3 h rest)	VAS score (pain): GI vs. GC ($p \leq .001$). Mean and SD after intervention: GI = 1.95 ± 0.82; GC = 4.95 ± 0.93
Basu et al. (2017), India	GI^1: Ichthammol glycerine GI^2: Heparinoid GI^3: Magnesium sulphate-glycerine	No reported protocol for the application of all three agents: only explanation of the application and dressing			3 days	Jackson Score: GI^1 vs. GI^2, GI^3 ($p \leq .0001$). Mean, SD and t baseline/3 days: GI^1 = (3.90 ± 0.59)/(0.12 ± 0.33), t = 36.18 GI^2 = (3.60 ± 0.55)/(0.14 ± 0.50), t = 25.48 GC = (3.65 ± 0.58)/(0.10 ± 0.63), t = 29.19
Jourabloo et al. (2017), Iran	GI^1: Calendula GI^2: Warm water compress GC: Untreated	Ointment Compress	2.5 g 45°C	Massage Moist compress for 20 min	8 h/3 days	Jackson Score: GI^1 vs. GC, GI^2 ($p \leq .001$). Mean, SD and p intra group baseline/1/2/3 day: GI^1 = (2.48 ± 0.62)/(3.46 ± 0.96)/(1.3 ± 0.417)/(1 ± 0.12), p = .002 GI^2 = (2.48 ± 0.50)/(3 ± 0.95)/(1.64 ± 0.64)/(1.2 ± 0.86), p = .006 GI^3 = (2.40 ± 0.64)/(3.02 ± 0.90)/(2.7 ± 0.91) /(2.9 ± 0.64), p = .07
Packialakshmi and Vidhya (2017), India	Magnesium sulphate-glycerine	Solution	20 g/100 ml glycerine	Not reported	12 h/3days	Pre-and post-test 3rd day. Mean, DS and t difference were $p < .001$: VIP Score: 2.4 ± 0.89; 0.1 ± 0.3, t = 14.99 Pain: 3.4 ± 1.08; 0.2 ± 0.41, t = 15.9 Intravenous infiltration: 0.8 ± 0.55; 0 ± 0, t = 7.96
Vidhya (2017), India	GI^1: Aloe vera GI^2:Magnesium sulphate	Fresh extract ointment Ointment	1 ml 30 mg	Application + gauze dressing Application + gauze dressing	12 h/2 days	Modified VIP Score: GI^2 vs. GI^1 ($p < .01$). Mean, SD and p post-test (0.002): GI^1 = 1.656 (SD 0.570) GI^2 = 1.432 (SD 1.145)
Yadav et al. (2016), India	GI^1: Aloe veraGI^2: GlycerineGI^3: Cold application	No reported protocol for the application of all three agents				VIP Score: GI^3 vs. GI^1 = G^2 ($p \leq .001$) Post-test assessment all groups: 26 (86.7%) No phlebitis and first signs: 12 (13.3%).

(Continues)

TABLE 2 (Continued)

Reference, country	Product	Presentation	Dosage	Mode of administration	Frequency of application	Results
Sharma (2016), India	GI[1]: Magnesium sulphate	Ointment	20 g/50 g glycerine	Application + gauze dressing	8 h/3 days	Signs and symptoms of superficial thrombophlebitis: GI[1] = GI[2] = G[3] ($p \leq .001$). GI[1] more effective. Pre- and post-test (mean, SD, t): GI[1] = (18.78 ± 1.833)/(2.16 ± 2.402), t = 20.82 GI[2] = (18.64 ± 1.723)/(3.60 ± 2.070), t = 11.90 GI[3] = (18.40 ± 1.773)/(3.34 ± 0.848), t = 14.33
	GI[2]: Heparinoid	Ointment	Not reported	Gentle massage		
	GI[3]: Cold application	Ice pack	Not reported	Ice in a plastic bag for 20 min		
Ghorbani et al. (2016), Iran	GI: Quercetin 2% (flavone)GC: Eucerin + water (placebo)	Ointment	15 g/ hand-made	Sterile dressing	12 h/3 days	Standard visual rating scale +symptoms: GI vs. GC ($p < .001$). Mean + SD before, 24, 48 and 72 h: GI[1] = (1.81 ± 0.58)/(0.69 ± 0.72)/ (0.30 ± 0.63)/(0.15 ± 0.44) GC = (1.81 ± 0.58)/(1.60 ± 0.49)/ (1.51 ± 0.66)/(1.48 ± 0.71)
Thomas et al. (2016), India	GI[1]:Ichthammol glycerine	Solution	Not reported	Compress + cotton bandage	12 h/3 days	VIP Score: GI[1] vs. GI[2] ($p \leq .001$). Mean ± SD 24 and 48 h: GI[1] = (2.33 ± 0.47)/(2.60 ± 0.49) GI[2] = (5.62 ± 1.23)/(6.15 ± 0.95)
	GI[2]: Heparinoid	Ointment	Not reported	Application + bandage		
Rukhsana et al. (2016), India	GI: Cold application	Ice pack	Not reported	20 min	8 h/3 days	VIP Score: GI = GC ($p < .05$). Pre- and post-test (mean, SD, t): GI = (3.07 ± 0.70)/(1.33 ± 0.49), t = 11.309 GC = (3.07 ± 0.59)/(1.27 ± 0.46), t = 12.435
	GC: Magnesium sulphate-glycerine	Ointment	Not reported	Not reported		
Jayabharathi (2015), India	GI[1]: Magnesium sulphate-glycerine	Ointment	20 g/50 g glycerine	15 min + bandage	8 h	Modified VIP Score: GI[1] vs. GI[2] ($p < .001$). Pre- and post-test (mean, SD): GI[1] = (13.13 ± 2.14)/(6.00 ± 0.79) GI[2] = (13.23 ± 2.39)/(6.47 ± 0.86)
	GI[2]: Cold application	Ice pack	Not reported	15 min	8 h/3 days	
Ravindra and Patel Krupa (2015), India	GI: Magnesium sulphate-glycerineGC: Not reported	Ointment	20 g/100 ml glycerine	Bandage + raise limb	12 h/2 days	Jackson Score: GI vs. GC ($p < .001$). GI: mean score 1.10 (SD 0.71). GC: mean score 2.53 (SD 0.78). Mean difference = −1.43, t = 7.454.
Soloman et al. (2015), India	GI[1]: Ichthammol glycerine GI[2]: Heparinoid	No reported protocol for the application of all the two agents				VIP Score: GI[1] = GI[2] ($p < .05$). Mean + SD before, 24 and 48 h GI[1] = (10.51 ± 2.13)/(6.37 ± 2.66)/ (1.50 ± 1.57) GI[2] = (10.14 ± 10.13)/(5.90 ± 3.04)/ (2.37 ± 2.36)

(Continues)

TABLE 2 (Continued)

Reference, country	Product	Presentation	Dosage	Mode of administration	Frequency of application	Results
Yambem et al. (2015), India	GI[1]:Magnesium sulphate-glycerine	Not reported			Not reported	Modified VIP Score: GI[1] vs. GI[2] ($p \leq .05$). Pre- and post-test (mean, SD): GI[1] = (3.80 ± 0.67)/(2.40 ± 0.74) GI[2] = (3.87 ± 0.74)/(3.13 ± 0.99)
	GI[2]: Heparinoid	Ointment	Benzyl nicotinate (2 mg) + heparin (50 ui)	Not reported		
Shilpa et al. (2015), India	GI: Hot applicationGC: Not reported	Compress	Not reported	5–10 min	12 h/3 days	VIP Score: GI vs. GC ($p < .05$). Pre- and post-test (mean, SD): GI = (2.02 ± 0.61)/(0.95 ± 0.59) GC = 1.32 ± 0.47)/(1.5 ± 0.71)

Abbreviations: CG, control Group; g, grams; GI, intervention group; GI[1], intervention group 1; GI[2], intervention group 2; GI[3], intervention group 3; h, hours; mg, milligrams; min, minutes; SD, standard deviation; ui, units; VAS, Visual Analog Scale; VIP, visual infusion phlebitis.

use (Mihala et al., 2018). In this regard, Ray-Barruel et al. (2014) reported the existence of 71 phlebitis assessment scales which included 15 different signs and symptoms, with the most common signs being erythema and pain. Consequently, there is a clear need for a consensus in relation to rigorous and validated instruments for the identification of PVC-related phlebitis to enable its optimal treatment and follow-up.

5.2 | Products used and their efficacy

A wide variability was found in the topical products administered for the treatment of phlebitis. These were classified into physical measures, and phytotherapeutic and pharmacological treatments.

The physical measures differ considerably, primarily in their application at different temperatures (cold, warm and hot). As in the present review, other studies support the use of warm compresses because of their vasodilating effect on the inflamed area (Annisa et al., 2017) or cold compresses to reduce the inflammation (Pérez Melgarejo, 2011). It is interesting to note that, according to the study by Gauttam and Vati (2016), both cold and warm compresses are equally effective against phlebitis (pain, erythema, induration and warmth). In this regard, it seems that the effect on the healing process is more related to the compress and the wet environment than the temperature (Bryant & Nix, 2016). It should also be noted that the physical measures are much more economic and, given their non-pharmacological nature, adverse effects are non-existent (Hidayah et al., 2017). However, the results obtained show a very limited efficacy. The studies included in this review undertook no comparisons (Hidayah et al., 2017; Shilpa et al., 2015) or were methodologically very poor (Yadav et al., 2016).

In relation to the phytotherapeutic treatments, the results of this review show their potential. Of the 11 selected studies, 8 report regression of the phlebitis. The tested products were calendula (Jourabloo et al., 2017), quercetin (Ghorbani et al., 2016), phellodendron (Wan, 2018), ichthammol glycerine (Basu et al., 2017; Thomas et al., 2016), sesame (Bigdeli Shamloo et al., 2019; Damanik, 2017) and chamomile (Lila, 2017). The results reported on the benefits of phytotherapeutic products concur with those of other studies and systematic reviews (Dos Reis et al., 2009; Gao et al., 2016; Goulart et al., 2020; Martín Gil et al., 2017). The efficacy of these products is due to their anti-inflammatory, anti-oxidant, anti-oedematous, anti-pyretic and anti-nociceptive properties (Bigdeli Shamloo et al., 2019). The only product that reported a lower benefit than the products it was compared with was aloe vera (Vidhya, 2017; Yadav et al., 2016), although this contradicts the results of other reviews (Zheng et al., 2014). However, it is important to note that studies performed with aloe vera (Gao et al., 2016; Zheng et al., 2014) assess the potential of their effects (softening of blood vessels and restoration of blood vessel elasticity; improved lymphocyte activity and human immunity; dilation of blood vessels and promotion of blood circulation; antibacterial functions with contribution to the repair of damaged tissue and promotion of wound healing and cell regeneration), but

are not conclusive and all of them recommend further, and more rigorous, studies. It is also important to bear in mind that many of the phytotherapeutic products are not marketed in western societies, which complicates their use (Higginson & Parry, 2011). Furthermore, a comparison of phytotherapeutic with pharmacological products is made more difficult by the fact that the latter products have been studied in greater depth and their efficacy has been more extensively demonstrated (Goulart et al., 2020).

Magnesium sulphate is the most widely used pharmacological product, although the efficacy of this product is associated to its application with glycerine. Magnesium sulphate contains magnesium, sulphur and oxygen that cleanses, moisturises the inflamed vein and reduces infection (Vidhya, 2017). While the glycerine improves the anti-inflammatory and hydrating properties as it avoids crystallisation of the layered structure of the stratum corneum, its hygroscopic property reduces loss of water from the skin (Kim et al., 2015). In addition, tolerance to glycerine is generally very high and adverse reactions are uncommon (Amuda et al., 2019).

Although heparinoids act at the epidermis level as anti-oedematous and decongestant agents with antiphlogistic and antithrombotic properties (Amuda et al., 2019; Nader et al., 2004), their efficacy is limited against all the other products they were compared with in this review (magnesium sulphate-glycerine, magnesium sulphate and ichthammol glycerine). No study reported a greater benefit of heparinoids for the regression or control of PVC-related phlebitis, although a similar efficacy was obtained in the study by Soloman et al. (2015). The ambiguity of the results may be due to the fact that both products have an anti-inflammatory and analgesic effect, but the ichthammol glycerine is also antibacterial (Bakshi et al., 2018).

5.3 | Pharmaceutical formulas and administration interventions

The treatments analysed in this review are wide-ranging in terms of their pharmaceutical formulas and administration (dosage, mode and frequency).

The most commonly used formula is ointment followed by solution and oil. However, the variety of treatments used does not allow an analysis by formula and product. For example, magnesium sulphate with and without glycerine was equally effective in solution or ointment form. No study compared the same product in different formulas. While both ointment and solution, the two most frequently used formulas, were found to be effective, in the studies by Bagheri-Nesami et al. (2014) and D'souza (2016) it is reported that the same product applied in ointment form has a greater efficacy than if applied in solution form. The fundamental difference between solution and ointment formulas lies in the different proportions of the oil and water that they contain. Ointments have a higher concentration of oil and are more greasy and emollient. The drawbacks of solution formulas include rapid evaporation of the water/alcohol, which influences the dissemination of the product and can result in an uneven topical dose in the treated area. In contrast, ointment is more uniformly distributed and is therefore a more appropriate formulation. In addition, the more oil there is and more greasy the product, the slower will be its absorption, and an ointment will therefore always remain on the skin for a longer time (Ivens et al., 2001).

With regard to the application of the product, massage or rubbing can increase the possibility of absorption (Sellarès Casas, 2013). In the study by Bigdeli Shamloo et al., (2019), it is highlighted that application of the product by a nursing professional with expertise in massage can increase its efficacy. Once the product has been applied, the placement of a bandage generates a certain amount of controversy in the consulted literature. On the one hand, the use of a bandage does not impede evaporation of the product nor does it improve its effectiveness (Lian et al., 2017), while on the other occlusion of the area increases the absorption of the product (Sellarès Casas, 2013) and keeps the skin moist. In this review, use of a bandage (sterile or gauze dressing) together with the product was found to be effective in a total of 9 studies (Amuda et al., 2019; Bigdeli Shamloo et al., 2019; Ghorbani et al., 2016; Jayabharathi, 2015; Packialakshmi & Vidhya, 2017; Ravindra & Patel Krupa, 2015; Sharma, 2016; Thomas et al., 2016; Wan, 2018).

The most frequent time of application in the selected studies is 3 days (17 products), while the minimum period is 2 days (8 products) and the longest is 7 days (1 product). The product is applied 2 or 3 times daily. In concurrence with Goulart et al. (2020), the length of time and frequency of application is attributable more to the viability of the study than to the substance that is being evaluated.

It should also be noted that the vast majority of the studies included in this review do not consider any adverse effects resulting from application of the product. It would therefore be of great interest to analyse this question in greater depth in order to assess the risk-benefit of the proposed interventions.

5.4 | Limitations of the review

In relation to the limitations of this review, one of the inclusion criteria was that the articles had to be written in English or Spanish to facilitate their interpretation. This criterion could have resulted in valid information being missed if the articles on topical treatments of phlebitis had only been published in Chinese or other Asian languages.

All the studies included in this review are Asian in origin, suggesting that further research in other national and international contexts is required to allow comparisons and reach a general consensus on treatments.

6 | CONCLUSIONS

This scoping review evidences areas in the treatment of PVC-related phlebitis that require further research and studies with greater methodological rigour. The topical treatments analysed in this

review were divided into physical measures and pharmacological and phytotherapeutic treatments. The high number of treatments used and the considerable differences in their application make any comparison difficult. The physical measures are cheap and easy to apply, but their efficacy is limited. While the phytosanitary products display good research potential, their use and marketing in western culture is limited. Finally, of the pharmacological products the magnesium sulphate (both with and without glycerine) gave better results than products such as heparinoids.

The most commonly used pharmaceutical formula is ointment, followed by solution and then oil. Massage and bandaging are actions related to the application of the products that enhance their absorption. However, the results do not allow the establishment of any clear evidence as to which product to use or how to use it.

7 | RELEVANCE TO CLINICAL PRACTICE

The variability of the products and their form of presentation for the treatment of PVC-related phlebitis shows heterogeneity in its assessment. The summary of the information offered in this scoping review in relation to the nature of the treatments, the pharmacological presentation, the mode of application and their effect in relation to the regression of the degree of phlebitis is a clinical decision aid for nurses in clinical practice. Furthermore, these results encourage them to deliberate on the basis of the evidence that is available, about the treatments that are administered in accordance with healthcare quality and patient safety. Basing decisions on evidence helps reduce errors, provides comfort to patients, avoids secondary complications and optimises economic resources.

Based on the above, magnesium sulphate either with or without glycerine is postulated as the most effective treatment for PVC-related phlebitis. However, there are products used in Asian regions that have not been tested in the Western context, so it is difficult to conclude which product is best. More evidence needs to be generated in different national and international contexts in order to foster a consensus with respect to the different products that are available and their application. Further progress in this respect is vital, as the assessment and treatment of this type of phlebitis is a responsibility that corresponds to the nurse. To know the applicability, costs, availability and evidence of these products will determine best practices.

CONFLICT OF INTERESTS

None declared.

AUTHOR CONTRIBUTIONS

All authors meet the criteria for authorship: (1) have made substantial contributions to conception and design, or acquisition of data, or analysis and interpretation of data; (2) been involved in drafting the manuscript or revising it critically for important intellectual content; (3) given final approval of the version to be published. Each author should have participated sufficiently in the work to take public responsibility for appropriate portions of the content; and (4) agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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